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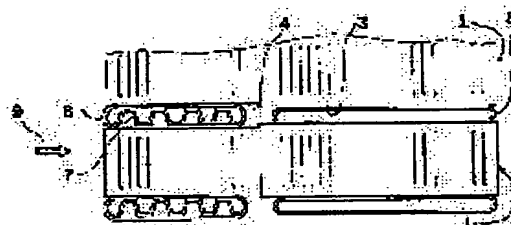
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(54) COMBINED HEAT EXCHANGER

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent thermal conduction from being generated between two heat exchangers as much as possible in a corrugated fin type heat exchanger having a main heat exchanger for cooling the cooling water of an engine formed integrally with a condenser for a car cooler.

SOLUTION: Slits 2 are formed in the top parts and bottom parts of respective waves in the intermediate position widthwise a corrugated fin 1. The radii of curvature of the top parts and the bottom parts of a first curved part 3 located in one side from the respective slits 2 in the intermediate position widthwise the corrugated fin 1 are smaller than those of a second curved part 4 in the other side. The amplitude L1 of the wave of the first curved part 3 is longer than the amplitude L2 of the wave of the second curved part 4. Then, a first flat tube 5 is fixed in contact to the first curved part 3 and a second flat tube 6 is fixed in contact to the second curved part 4.



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CLAIMS

[Claim(s)]

[Claim 1] Ups-and-downs formation of the light-gage metal band material is carried out, and the corrugated fin 1 is constituted so that a wave may be advanced only to a longitudinal direction. In the mid-position of the cross direction of the corrugated fin 1 It cuts deeply to the travelling direction of the wave to the crowning and trough of each wave, and 2 is formed. Bordering on said each slitting 2 The radius of curvature of the crowning of the 1st bend 3 which is the one side of said cross direction, and a trough is formed in smallness rather than them of the 2nd bend 4 of the other side. Wave amplitude L1 of the 1st bend 3 Wave amplitude L2 of the 2nd bend 4 It is formed for a long time. the difference of the wave amplitude of both the bends 3 and 4 — the — the minor axis of the 2 flat tube 6 — comparing — the [of the minor axis / short] — the 1 flat tube 5 contact immobilization is carried out at said 1st bend 3 — having — the [said] — the 2 flat tube 6 carries out contact immobilization at said 2nd bend 4 — having — the [said] — the [the 1 flat tube 5 and], while a heat exchange medium which is different in the 2 flat tube 6, respectively circulates The compound-die heat exchanger constituted so that the airstream 9 for cooling might circulate crosswise [of the corrugated fin 1 / said].

[Claim 2] It sets to claim 1 and is wave amplitude difference L1-L2 of said both bends 3 and 4. Compound-die heat exchanger which is 0.2mm - 0.5mm.

[Claim 3] claim 1 — setting — the [said] — the compound-die heat exchanger by which the inner fin 7 was inserted only into the 2 flat tube 6.

[Claim 4] claim 3 — setting — the [said] — the 2 flat tube 6 — ** material — tubed — bending — both the edge — liquid — the compound-die heat exchanger which consists of what was joined densely.

[Claim 5] while it sets to claim 3 and one ** material bends by return in flat tubed, the seal section 8 forms in the crosswise pars intermedia — having — a boundary [section / 8 / the / seal] — the cross direction — one side — the [said] — the 1 flat tube 5 arranges — having — the other side — the [said] — the compound-die heat exchanger by which the 2 flat tube 6 was formed in one.

[Claim 6] claim 1 — setting — the — car motor cooling water leads in the 1 flat tube 5 — having — the — the compound-die heat exchanger constituted so that the refrigerant for air conditioning in the car might circulate in the 2 flat tube 6.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention is the compound-die heat exchanger which unified the heat exchanger for engine-coolant water cooling arranged mainly in the engine room of an automobile, and the heat exchanger for car air conditioners, and relates to what has a common corrugated fin.

[0002]

[Description of the Prior Art] In the plate fin mold heat exchanger which has two or more tube trains, the proposal made to circulate a different heat exchange medium for every tube is made. And in order to prevent that heat transfer is carried out to the tube of another side from one tube through a fin since a temperature gradient arises in the tube of each train as much as possible, what formed the slit in those middle exists.

[0003]

[Problem(s) to be Solved by the Invention] The compound-die heat exchanger using a plate fin needed to make many plate fins arrange in parallel through areole, needed to insert one tube in each tube insertion hole at a time, and had a fault with the troublesome manufacture. Then, this invention makes it a technical problem to offer the high thing of the mass-production nature which can prevent that heat conduction happens between the tubes which adjoin through a fin as much as possible in the compound-die heat exchanger which used the corrugated fin.

[0004]

[Means for Solving the Problem] Ups-and-downs formation of the light-gage metal band material is carried out, and the compound-die heat exchanger of this invention constitutes the corrugated fin 1 so that a wave may be advanced only to a longitudinal direction, and it is the mid-position of the cross direction of the corrugated fin 1. It cuts deeply to the travelling direction of the wave to the crowning and trough of each wave, and 2 is formed. Bordering on said each slitting 2 The radius of curvature of the crowning of the 1st bend 3 which is the one side of said cross direction, and a trough is formed in smallness rather than them of the 2nd bend 4 of the other side. Wave amplitude L1 of the 1st bend 3 Wave amplitude L2 of the 2nd bend 4 It is formed for a long time. the difference of the wave amplitude of both the bends 3 and 4 — the — the minor axis of the 2 flat tube 6 — comparing — the [of the minor axis / short] — the 1 flat tube 5 contact immobilization is carried out at said 1st bend 3 — having — the [said] — the 2 flat tube 6 carries out contact immobilization at said 2nd bend 4 — having — the [said] — the [the 1 flat tube 5 and], while a heat exchange medium which is different in the 2 flat tube 6, respectively circulates It is constituted so that the airstream 9 for cooling may circulate crosswise [of the corrugated fin 1 / said].

[0005] thus, the compact compound-die heat exchanger which has the corrugated fin 1 which is common by constituting — setting — the — the [the 1 flat tube 5 and] — heat transfer between the 2 flat tubes 6 is cut deeply, and it can prevent effectively by 2. namely, the slitting 2 — the — the [the 1st bend 3 by which direct contact immobilization of the 1 flat tube 5 is carried out, and] — since the 2 flat tube 6 is arranged between the 2nd bend 4 by which direct contact immobilization is carried out, it is in the minimum distance of both the contact section,

and heat transfer between both can be prevented most efficiently. And wave amplitude L1 of the 1st bend 3 Wave amplitude L2 of the 2nd bend 4 Since it is formed for a long time and a level difference arises there, heat transfer between both tubes is effectively prevented also with the level difference. And change arises [airstream 9] with flow in the level difference section, it stirs and heat exchange is promoted.

[0006] Next, this invention according to claim 2 is the gestalt of desirable implementation of invention according to claim 1, and is wave amplitude difference L1-L2 of said both bends 3 and 4. It is the compound-die heat exchanger which is 0.2mm - 0.5mm. next, the gestalt of the implementation of invention of said claim 1 with desirable this invention according to claim 3 — it is — the [said] — it is the compound-die heat exchanger by which the inner fin 7 was inserted only into the 2 flat tube 6. the [in which this inner fin 7 is inserted] — the 2 flat tube 6 — the minor axis of that cross section — the — since it is formed in size rather than that of the 1 flat tube 5, even if the inner fin 7 exists in that interior — per unit cross section — like — heat exchange can be promoted from existence of the inner fin 7, without increasing circulation resistance so much.

[0007] next, the gestalt of the implementation of said invention according to claim 3 with desirable this invention according to claim 4 — it is — the [said] — the 2 flat tube 6 — ** material — tubed — bending — both the edge — liquid — it is the compound-die heat exchanger which consists of what was joined densely. next, the seal section 8 forms this invention according to claim 5 in the crosswise pars intermedia while it is the gestalt of desirable implementation of said invention according to claim 3 and one ** material bends it by return in flat tubed — having — a boundary [section / 8 / the / seal] — the cross direction — one side — the [said] — the 1 flat tube 5 arranges — having — the other side — the [said] — the 2 flat tube 6 is the compound-die heat exchanger formed in one. thus, one ** material — the — the [the 1 flat tube 5 and] — by constituting the 2 flat tube 6, a compound-die heat exchanger with an easy assembly with few [and] components mark can be offered.

[0008] the gestalt of the implementation of said invention according to claim 1 with still more desirable this invention according to claim 6 — it is — the — car motor cooling water leads in the 1 flat tube 5 — having — the — it is the compound-die heat exchanger constituted so that the refrigerant for air conditioning in the car might circulate in the 2 flat tube 6. the [thus,] — car motor cooling water leads in the 1 flat tube 5 — having — the — a compact and economical compound-die heat exchanger can be offered in the engine room of a narrow automobile by constituting so that the refrigerant for air conditioning in the car may circulate in the 2 flat tube 6.

[0009]

[Embodiment of the Invention] Next, the gestalt of operation of this invention is explained based on a drawing. Drawing 1 is the strabism schematic drawing of the corrugated fin 1 used for the compound-die heat exchanger of this invention. This corrugated fin 1 carries out ups-and-downs formation of the light-gage metal band material so that a wave may be advanced only to a longitudinal direction, the louver 10 of a large number which inclined in the standup side and falling side of that wave, respectively cuts it, and lifting formation is carried out. And with the crosswise mid gear of the corrugated fin 1, it cuts to the crowning and trough of each wave deeply to the travelling direction of the wave, and 2 is formed in them. And bordering on each slitting 2, the radius of curvature of the crowning of the 1st bend 3 which is the one side of the cross direction, and a trough is formed in smallness rather than them of the 2nd bend 4 of the other side, and it is the wave amplitude L1 of the 1st bend 3. Wave amplitude L2 of the 2nd bend 4 It is formed for a long time.

[0010] the [and / which has been arranged at two trains as such a corrugated fin 1 is shown in drawing 2 and drawing 3] — the [the 1 flat tube 5 and] — it is infixed between each tube of the 2 flat tube 6. and the minor axis of the cross section — smallness — the — the flat side face of the 1 flat tube 5 — the 1st bend 3 of the corrugated fin 1 — contacting — the [of a minor axis / big] — the 2nd bend 4 contacts it of the 2 flat tube 6. the [and / the corrugated fin 1 and] — the [the 1 flat tube 5 and] — the contact section with the 2 flat tube 6 is soldered or soldering fixed mutually the [this] — the [the minor axis of the cross section of

the 1 flat tube 5, and] — the difference with the minor axis of the cross section of the 2 flat tube 6 — said L1-L2 It is equal. As for this difference, it is desirable that it is 0.2mm — about 0.5mm. and a minor axis — size — the — the inner fin 7 is inserted into the 2 flat tube 6. In addition, in this example, as for the width of face of the 1st bend 3, the twist is also formed in it of the 2nd bend 4 for a long time. the [and] — the major axis of the cross section of the 1 flat tube 5 — the — what also has a long twist is used for it of the 2 flat tube 6.

[0011] the [each] — the both ends of the 1 flat tube 5 are open for free passage to the 1st header which a pair does not illustrate — having — the [each] — the 2nd header of the pair which does not illustrate the both ends of the 2 flat tube 6, either is open for free passage. and — this example — the — the inside of the 1 flat tube 5 — an engine cooling water — circulating — the — the refrigerant for car air conditioners circulates in the 2 flat tube 6. moreover, the airstream 9 — like drawing 1 and drawing 3 — the — the [from the 2 flat tube 6 side] — the 1 flat tube 5 side — circulating — thereby — the — the [the refrigerant in the 2 flat tube 6, and] — the engine cooling water in the 1 flat tube 5 is cooled.

[0012] next, the gestalt of the operation of others [drawing 4] of this invention — it is — this example — the — the 2 flat tube 6 — ** material — tubed — bending — both that edge — liquid — it joins densely. moreover, the example of further others [drawing 5] — it is — the — the [the 2 flat tube 6 and] — the 1 flat tube 5 is formed in one. that is, while one ** material of ***** bends by return in flat tubed, the seal section 8 forms in the crosswise center section — having — a boundary [section / 8 / the / seal] — the one side of the cross direction — the — the 1 flat tube 5 — the other side — the — the 2 flat tube 6 is arranged. In addition, although a compound-die heat exchanger is the combination of the capacitor for car air-conditioners, and the heat exchanger for engine-coolant water cooling in this example, it may replace with a capacitor and an oil cooler may be arranged.

[0013]

[Function and Effect of the Invention] the compound-die heat exchanger of this invention — the — the [the 1st bend 3 which the 1 flat tube 5 contacts, and] — since it cuts deeply on a boundary with the 2nd bend 4 which the 2 flat tube 6 contacts and 2 is formed, heat transfer between both the tubes through the corrugated fin 1 can be prevented effectively. That is, since it cut deeply on the boundary line of the 1st bend 3 by which contact immobilization of each tube is carried out, and the 2nd bend 4 and 2 was prepared, it is in the minimum distance of both the contact section, and can prevent heat transfer between both tubes most efficiently.

Furthermore, since the level difference is formed between the 1st bend 3 and the 2nd bend 4 by which contact immobilization of them is carried out, heat transfer between both tubes can be further prevented effectively by existence of the level difference. Namely, wave amplitude L1 of the 1st bend 3 Wave amplitude L2 of the 2nd bend 4 Since it is formed for a long time, a level difference arises in the boundary line, and since the heat transfer distance between both tubes becomes long [the part], heat transfer between both tubes can be prevented effectively.

[0014] the [moreover,] — the [the 1st bend 3 by which contact immobilization of the 1 flat tube 5 is carried out, and] — when the level difference section exists between the 2nd bend 4 by which contact immobilization of the 2 flat tube 6 is carried out, in the level difference section, change arises with flow, is stirred, and airstream 9 can promote heat exchange. further — the — the minor axis of the 2 flat tube 6 — the — it of the 1 flat tube 5 — large — it can carry out — the part — the — circulation resistance per unit cross section of the 2 flat tube 6 interior can be made into smallness, and, thereby, many heat exchange media can be circulated. the [and] — the heat exchange engine performance of the 2 flat tube 6 may be improved. the [next,] — the compound-die heat exchanger by which the inner fin 7 was inserted only into the 2 flat tube 6 — setting — the — the minor axis in the cross section of the 2 flat tube 6 — the — since it is size from it of the 1 flat tube 5 — the — the heat exchange engine performance may be improved further, without enlarging circulation resistance in the 2 flat tube 6 so much.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] Strabism schematic drawing of the corrugated fin 1 used for the compound-die heat exchanger of this invention.

[Drawing 2] the [each corrugated fin 1 used for this compound-die heat exchanger, and] — the [the 1 flat tube 5 and] — the explanatory view showing a contact condition with the 2 flat tube 6.

[Drawing 3] This contact condition is shown and it can set to drawing 2 . III-III view sectional view.

[Drawing 4] The important section sectional view of other compound-die heat exchangers of this invention.

[Drawing 5] The important section sectional view of the compound-die heat exchanger of further others of this invention.

[Description of Notations]

1 Corrugated Fin

2 Slitting

3 1st Bend

4 2nd Bend

5 the — 1 Flat Tube

6 the — 2 Flat Tube

7 Inner Fin

8 Seal Section

9 Airstream

10 Louver

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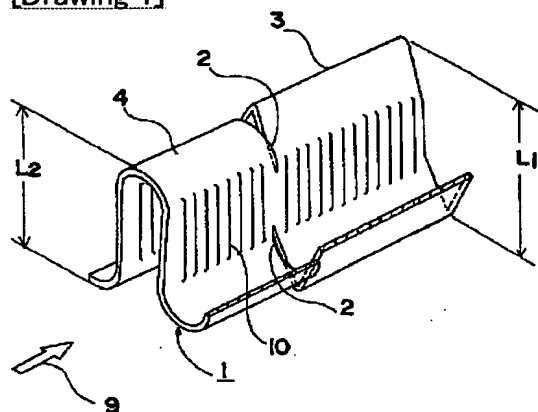
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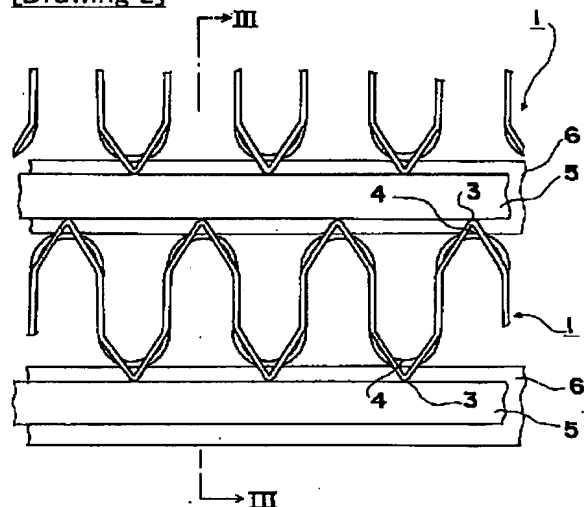
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DRAWINGS

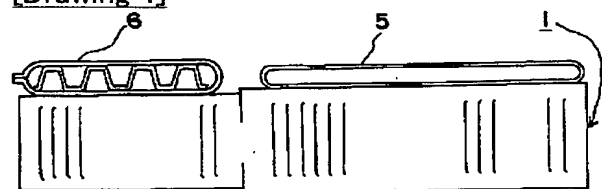
[Drawing 1]



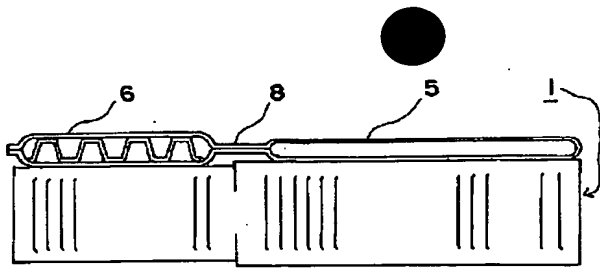
[Drawing 2]



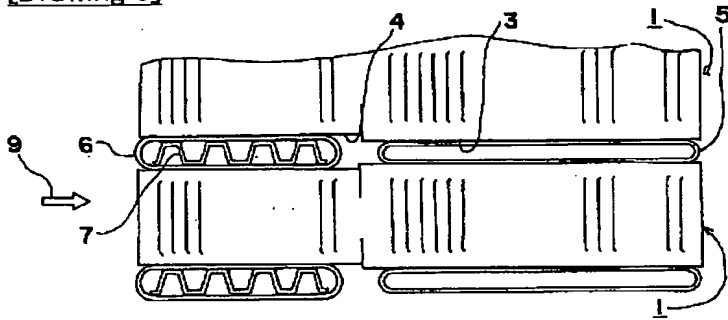
[Drawing 4]



[Drawing 5]



[Drawing 3]



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